

Serial No. 09/839,941

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Remarks

Applicants appreciate the consideration shown by the Office, as evidenced by the most recent Final Office Action, mailed on January 28, 2003, and the telephone interviews with Examiner Wai Sing Louie on March 27 and April 25, 2003. In that Final Office Action, Claims 1-46 and 59-106 were rejected by the Examiner. Claims 50-58 and 107-114 were previously withdrawn from consideration and canceled, without prejudice. As such, Claims 1-46 and 59-106 remain in the case with none of the claims being allowed.

The January 28 Final Office Action and the telephone interviews with the Examiner have been carefully considered. After such consideration, Claims 1 and 59 have been amended. Applicants respectfully request reconsideration of the application by the Examiner in light of the above amendments and the following remarks offered in response to the January 28 Final Office Action.

In the January 28 Final Office Action, the Examiner rejected Claims 1-5, 14, 18, 19, 33, 36, 59-62, 71, 75 and 76 under 35 U.S.C. § 103(a) as being unpatentable over Chen (U.S. Patent No. 6,104,074) in view of Tischler et al. (U.S. Patent No. 5,679,152) and Tanaka et al. (U.S. Patent No. 6,377,596). Claims 6-13, 15-17, 20-22, 63-70, 72-74, 77-79 and 107 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Chen in view of Soares (U.S. Patent No. 6,034,404). Claims 23-32, 34, 35, 37-44, 80-92 and 94-101 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Chen in view of Mueller (U.S. Patent No. 4,902,136) and Gerner et al. (U.S. Patent No. 5,698,865). Claims 45-49 and 102-106 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Chen in view of Saito et al. (U.S. Patent No. 6,121,634).

Applicants submit that independent Claims 1 and 59 have each been amended to recite the limitation of a substrate comprising a single crystal gallium nitride wafer, wherein the gallium nitride wafer is grown by precipitating gallium nitride onto one of at least one gallium nitride crystal, a gallium nitride boule, and a gallium nitride crystal seed.

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In the April 25 telephone interview, the Examiner suggested that Claim 59 be amended to clarify that the stoichiometric coefficients  $x$ , and  $y$ ,  $z$  and  $w$  in the formula  $\text{Ga}_{1-x-y}\text{Al}_x\text{In}_y\text{N}_{1-z-w}\text{P}_z\text{As}_w$  do not all equal zero. Accordingly, Applicants submit that Claim 59 has been additionally amended to recite the limitation of at least one active layer disposed on said gallium nitride substrate, said at least one active layer comprising  $\text{Ga}_{1-x-y}\text{Al}_x\text{In}_y\text{N}_{1-z-w}\text{P}_z\text{As}_w$ , wherein  $0 \leq x, y, z, w \leq 1$ , at least one of  $x$  and  $y$  has a non-zero value, and  $0 < x + y \leq 1$ .

Applicants submit that, in order to establish a *prima facie* case of obviousness, the references must teach or suggest all of the claim limitations of the present invention.

Accordingly, Applicants submit that neither Chen nor Tischler et al. nor Tanaka et al. teach a substrate comprising a single crystal gallium nitride wafer that is grown by precipitating gallium nitride onto one of at least one gallium nitride crystal, a gallium nitride boule, and a gallium nitride crystal seed. As noted by the Examiner in the January 28 Final Office Action, Chen does not disclose a GaN substrate. Applicants submit that Tischler et al. and Tanaka et al., by disclosing growth of GaN on silicon and silicon carbide, respectively, actually teach away from GaN growth on a GaN seed. Alternatively, Applicants submit that the fact that both Tischler et al. and Tanaka et al. deposit GaN on so-called "handling substrates" having lattice mismatches with GaN deposited thereon demonstrates the failure - and hence the long-felt need - in the prior art to produce a free-standing GaN substrate or wafer. Applicants therefore submit that, because the combination of references cited by the Examiner neither teaches nor suggests all of the limitations of amended Claims 1 and 59, the rejection of these claims and the claims dependent thereon under 35 U.S.C. § 103(a) as being unpatentable over Chen in view of Tischler et al. and Tanaka et al. is successfully overcome. Applicants further submit that, because Claims 1 and 59 are now in condition for allowance, the remaining rejections of Claims 2-49 and 60-106 are now moot, and should therefore be withdrawn.

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In light of the amendments and remarks presented herein, Applicants submit that the case is in condition for immediate allowance and respectfully request such action. If, however, any issues remain unresolved, the Examiner is invited to telephone the Applicants' counsel at the number provided below.

Respectfully submitted,



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## ATTACHMENT A

Marked-up versions of amended Claims 1 and 59 are provided below.

**Marked-up version of Claim 1:**

1. (Three times amended) A photodetector, said photodetector, comprising:
- a) a substrate, said substrate comprising a single crystal gallium nitride wafer having a dislocation density of less than about  $10^3 \text{ cm}^{-2}$ , wherein said gallium nitride wafer is grown by precipitating gallium nitride onto one of at least one gallium nitride crystal, a gallium nitride boule, and a gallium nitride crystal seed;
  - b) at least one active layer disposed on said substrate; and
  - c) at least one conductive contact structure affixed to at least one of said substrate and said at least one active layer.

**Marked-up version of Claim 59:**

59. Twice amended) A photodetector, said photodetector comprising:
- a) a gallium nitride substrate, said gallium nitride substrate comprising a single crystal gallium nitride wafer and having a dislocation density of less than about  $10^5 \text{ cm}^{-2}$ , wherein said single crystal gallium nitride wafer is grown by precipitating gallium nitride onto one of at least one gallium nitride crystal, a gallium nitride boule, and a gallium nitride crystal seed;
  - b) at least one active layer disposed on said gallium nitride substrate, said at least one active layer comprising  $\text{Ga}_{1-x-y}\text{Al}_x\text{In}_y\text{N}_{1-z-w}\text{P}_z\text{As}_w$ , wherein  $0 \leq x, y, z, w \leq 1$  and at least one of x and y has a non-zero value, wherein  $0 \leq x + y \leq 1$ , and  $0 \leq z + w \leq 1$ ; and
  - c) at least one conductive contact structure affixed to at least one of said gallium nitride substrate and said at least one active layer.